

**United States
Environmental Protection Agency
Office of Transportation and Air Quality
National Vehicle and Fuel Emissions Laboratory
2565 Plymouth Road
Ann Arbor, MI 48105**

**MAHA Dynamometer
Vehicle Installation and Removal Procedure**

This procedure is written for the Environmental Protection Agency, National Vehicle and Fuel Emissions Laboratory (NVFEL) internal use. The use of specific brand names by NVFEL in this procedure is for reference only and is not an endorsement of those products. This document may be used for guidance by other laboratories.

NVFEL Reference Number

724

Implementation Approval

Original Procedure Authorized by EPCN # 402 and released on 12/20/05

Revision Description

Table of Contents

1.	Purpose:	4
2.	Applicability:	4
3.	References:	4
4.	Required Equipment:	4
5.	Precautions:	5
6.	Visual Inspection:	5
7.	Preparation:	5
8.	Procedure:	6
100	Setting the Wheelbase - 4WD/AWD Only:	6
200	Installing the Vehicle:	6
300	Centering the Vehicle:	7
400	Restraining the Vehicle:	8
500	Position the Safety Barriers:	10
600	Other Pre-Test Setups and Checks:	10
700	Vehicle Removal:	11
9.	Data Input:	12
10.	Data Analysis:	12
11.	Data Record and Output:	12
12.	Acceptance Criteria:	12
13.	Quality Provisions:	13

Table of Figures

Figure 1	2 WD Wheel Clamping Device	8
Figure 2	4 WD Anchoring Method	9
Figure 3	Safety Barrier	10

Attachments

Attachment "A"	NVFEL Form 700-03 "Pre-conditioning and Sample Collection"	14
----------------	--	----

1. Purpose:

The following procedure describes the process for the installation, set-up and removal of either a 2WD or 4WD vehicle to be operated on the 4WD MAHA 48M/4X4 electric dynamometer.

2. Applicability:

This procedure is applicable to vehicle operating at speeds less than 85 mph (137 kph) on the MAHA 4WD dynamometer in site 329.

3. References:

- 3.1 NVFEL 709 "Hot Soak Evaporative Emission Test Procedure".
- 3.2 NVFEL 701 "Vehicle Inspection and Acceptance" procedure
- 3.3 NVFEL Form 700-01 "Test Parameters / Data"
- 3.4 NVFEL Form 700-03 "Preconditioning & Sample Collection" (shown in Attachment "A")
- 3.5 "MAHA AIP-ECDN 48M/ 4X4 Dynamometer Operation Manuals"
- 3.6 Blueprint file drawings TO4 88B-(0-11)
- 3.7 NVFEL current safety policies and procedures

4. Required Equipment:

- 4.1 Exhaust Connectors fabricated to meet requirements of blueprint file drawings TO4 88B-(0-11).
 - 4.1.1 Flexible exhaust tubes
 - 4.1.2 Exhaust tube adapters
 - 4.1.3 Clamps
 - 4.1.4 Gaskets and boot assembly
- 4.2 A fixed-speed cooling fan with a capacity not exceeding 5,300 cubic feet per minute (cfm) for the FTP and HFET tests and 15,000 cfm for the USO6. Additional or special cooling fans may be used if approved in advance by Certification Division or the appropriate Task Officer
 - 4.2.1 Typical equipment used: Hartzell Fan Model #N24-DUWS
- 4.3 Compressed air supply with air hose, tire inflation chuck, and calibrated pressure gauge
- 4.4 Vehicle restraining devices
- 4.5 Impact wrench and sockets

5. Precautions:

- 5.1 Personnel in the test cell should avoid close proximity to the vehicle when the dynamometer roll cradle is raised or lowered. The vehicle may shift up to a foot when the cradle is raised or lowered.
- 5.2 Vehicle must be securely restrained prior to start of test.
- 5.3 Components connected to the exhaust system will become hot during test and could cause burns to skin upon removal after testing is completed.
- 5.4 The vehicle setup described in this procedure is not suitable for vehicles operated in excess of 85 mph (137 kph). Consult with the team leader regarding any non-standard vehicle set up before operating the vehicle on the dynamometer.

6. Visual Inspection:

- 6.1 Ensure the access area to the dynamometer is clear and free of equipment or extraneous material that will interfere with the installation of the vehicle on or removal from the dynamometer.
- 6.2 Ensure that the wheel restraints and straps are in good condition and free of significant wear.
- 6.3 Ensure that the test cell air handler is in the “TEST” mode.

7. Preparation:

- 7.1 Prior to installation, the test vehicle shall be prepared in accordance with NVFEL 701 “Vehicle Inspection and Acceptance”.
- 7.2 Ensure that the correct starting procedures are located in the vehicle. If they are not locate the documents before proceeding.

8. Procedure:

The following steps are performed after acceptance of the vehicle and initial set-up of the dynamometer. Unless otherwise indicated, the driver is responsible for ensuring that the following steps are performed and documented on Form 700-03 "Preconditioning & Sample Collection" (Shown in Attachment "A").

100 Setting the Wheelbase - 4WD/AWD Only:

Note: Section 100 is only applicable to 4WD/AWD vehicles. For 2WD vehicles proceed directly to Section 200.

101 To set the wheelbase using the "DynoServer" software screen:

Enter or confirm the target value in the entry field "WHEELBASE" on the "DynoServer" screen. If a vehicle or model has been previously loaded from the database, the vehicle wheelbase stored there will be displayed. This can be confirmed or overwritten.

After the wheelbase has been confirmed or correctly entered, use the "START" button and the movable set of rolls will automatically move to the set target value.

102 To set the wheelbase using the operating panel or remote:

Press the function key 9 <WHEELBASE +> and/or function key 12 <WHEELBASE -> to move the movable set of rolls forward or backward to the desired location. The rolls will move as long as the applicable key is pressed.

103 Proceed to Section 200 when the wheelbase has been set.

200 Installing the Vehicle:

201 Ensure the safety barriers are at or near their outermost position.

202 Press the function key 3 <BRAKE ON> on the operating panel or remote control, or use the "BRAKE" on/off button on the "DynoServer" screen. The indication light on the extended DSU will light up when the rolls are blocked.

203 Use function key 8 <COVER OPEN/CLOSE> on the operating panel or remote control or the "COVER" button on the "DynoServer" screen to open the roll cover.

204 Check that all accessory switches on the test vehicle are in the "Off" position prior to starting the engine.

- 205 Slowly move or drive, as applicable, the test vehicle onto the dyno rolls in a straight direction and position the vehicle in the center of the dyno.

For all cold start tests including the FTP; do not start the engine, place the drive wheels of the vehicle on the dynamometer roll, and leave the vehicle in neutral.

For all hot start tests including the HFET; drive the vehicle onto the dynamometer, locating the drive wheels on the dynamometer roll, and leave the vehicle in neutral.

Note: NVFEL Form 701-01 "Test Parameters / Data" provided with the test packet specifies the drive axle.

- 206 Ensure that transmission is not engaged and the parking brake is off.
- 207 Ensure the front axle wheels are straight ahead in driving direction and the steering wheel lock is not engaged.

300 Centering the Vehicle:

- 301 Select the axle mode FA (front) or RA (rear) or 4WD on the DynoServer screen.
- 302 Press function key 1 <CENTERING UP> on the operating panel or remote control or the "↑ Cent." button on the "DynoServer" screen to activate the centering function. The support rolls of the vehicle centering device are automatically extended until they touch the test vehicle's wheels. Either the front and/or rear centering devices will be activated depending on the axle mode set for the test program. Also the dyno roll blocking is automatically released when the support rolls are extended.
- 303 Activate the jog operation on the operating panel or remote control using function key 7 <ROTATE ROLL> or press and hold the "JOG" button on the "DynoServer" screen. The dyno will accelerate the rolls up to 4 mph and the vehicle adjusts itself parallel to the dyno middle axle and centers on the apex of the rolls.
- 304 Careful corrections using the vehicle steering wheel assists the dyno in aligning front wheel drive and four wheel drive vehicles.

Note: Do not return the centering device to its' home position until the vehicle is restrained on the dynamometer.

400 Restraining the Vehicle:

The vehicle shall be fixed on the dynamometer with suitable restraining devices before testing. The restraining method shall prevent forward movement as well as lateral swing and any oscillating movement.

401 2 WD Rear Axle Driven Vehicles:

Secure each front wheel with a wheel clamping device as shown in Figure 1.



Figure 1
2 WD Wheel Clamping Device

402 2 WD Front Axle Driven Vehicles:

Secure each rear wheel with a wheel clamping device as shown in Figure 1. Secure the locking nuts which bolt the free end of the linkage bars to the tee-slot tracks and the center nut which connects the two arms using an impact wrench.

Secure the front of the vehicle with tie down straps.

Note: Ensure the straps are securely attached to a sturdy section of the vehicle frame.

403 4 WD Driven Vehicles:

Secure the vehicle front and rear using the anchoring posts. See Figures 2 for a typical method of anchoring, other methods may be used provided forward, lateral and oscillating movement is restricted.

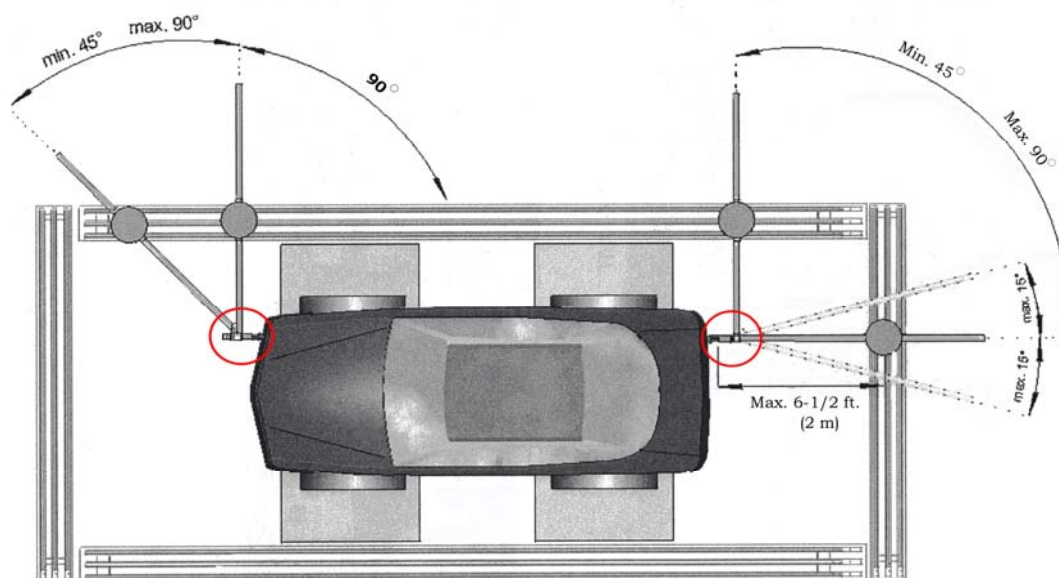


Figure 2
4 WD Anchoring Method

Lower the centering devices by pressing function key 4 <CENTERING DOWN> on the operating panel or remote control or use the “↓ Cent.” button on the “DynoServer” screen to return the centering devices to their home position.

Use function key 8 <COVER OPEN/CLOSE> on the operating panel or remote control or the “COVER” open/close toggle button on the “DynoServer” screen to close the roll cover.

Ensure all restraints are properly tightened prior to start of testing.

Ensure the restraining arms are level using the built in bubble levels

Ensure the restraining arm connections in the areas shown by the circles in Figure 2 are secure.

500 Position the Safety Barriers:

- 501 Open the red lever on the safety barrier's base and push the safety barriers (Shown in figure 3) toward the test vehicle's drive wheel housings. Allow for 2 to 12 inches clearance and then close the red lever.



Figure 3
Safety Barrier

600 Other Pre-Test Setups and Checks:

- 601 If an exhaust sample analysis is required, use the appropriate connectors and flexible hose to connect the vehicle exhaust system to the Horiba Analysis System CVS.

If not, the vehicle exhaust may be routed to an “exhaust dump”.

Note: Ensure a silicone gasket is installed in the Marmon flange joints.

- 602 Open the hood or engine compartment cover.

- 603 Position the cooling fan(s) within 12 inches of the vehicle unless otherwise specified on Form 700-03 “Preconditioning & Sample Collection” shown in Attachment “A” and turn the power to the cooling fan(s) on.

Note: In the case of vehicles with rear engine compartments (or if special designs make the above impractical), the cooling fan(s) shall be placed in a position to provide sufficient air to maintain vehicle cooling.

- 604 Using a calibrated tire pressure gauge, check and if necessary, adjust the drive tire pressure to the pressure specified on Form 700-03 “Preconditioning & Sample Collection”.

- 605 Record the following information in the Vehicle Preconditioning section of Form 700-03 “Preconditioning & Sample Collection”;

The hood/engine compartment cover is open and the fan is operational.

The fan placement(s) in the vehicle drawing area provided.

The actual drive tire pressure as verified or set.

- 606 Proceed with the required vehicle operation when all installation and setup processes are completed.

700 Vehicle Removal:

Note: The following steps are normally performed after completion of the required tests and verification of the reported data. However, when necessary these steps may be used at anytime to remove the vehicle.

- 701 Move the safety barriers away from the wheel housings.
- 702 Use function key 8 <COVER OPEN/CLOSE> on the operating panel or remote control or the “COVER” button on the “DynoServer” screen to open the roll cover.
- 703 Press function key 3 <Brake On> on the operating panel or remote control unit or use the “BRAKE” on/off toggle button on the DynoServer screen to apply the brake.
- 704 Press function key 1 <CENTERING UP> on the operating panel or remote control or the “↑ Cent.” button on the “DynoServer” screen to raise the centering devices into position to hold the vehicle in place. The support rolls of the vehicle centering device are automatically extended until they touch the test vehicle’s wheels. Either the front and/ or rear centering devices will be activated depending on the axle mode set for the test program.
- 705 Disconnect the vehicle restraining devices.
- 706 Disconnect the connections to the exhaust system from the analysis system.
- 707 Close the vehicle engine compartment cover so that it is fully latched and move the cooling fan(s) out of the way.
- 708 Turn the “Remote” mode off by clicking on the “Remote” button in the “DynoServer” screen

- 709 Drive the vehicle off the dynamometer at the minimum necessary throttle. If a SHED hot soak is required, drive the vehicle to the entrance of the evaporative SHED as soon as it is disconnected. Reference NVFEL 709 "Hot Soak Evaporative Emission Test Procedure".

Note: If this is an FTP Test the vehicle engine must be turned off within five (5) minutes of test completion.

9. Data Input:

- 9.1 Enter data as instructed in the Section 8 "Procedure" of this document.

10. Data Analysis:

- 10.1 Not Applicable

11. Data Record and Output:

- 11.1 The technician records the applicable requested data on NVFEL Form 700-03 "Preconditioning & Sample Collection" (Shown in Attachment "A") and signs and dates the form upon completion.

NVFEL Form 700-03 "Preconditioning & Sample Collection" remains with the vehicle in the test data packet until the relevant tests are completed.

12. Acceptance Criteria:

- 12.1 The vehicle must be installed approximately perpendicular to the dynamometer rolls.
- 12.2 The vehicle restraining hardware must be in good physical condition.
- 12.3 The exhaust connection hardware shall be in good physical condition and free of any obvious leak points.
- 12.4 All Marmom flange type connections must be assembled with a silicone gasket on one flange face. The gasket must be free of visible wear.
- 12.5 The tire pressure must be set at the tire pressure specified on NVFEL Form 700-03 "Preconditioning & Sample Collection" (Shown in Attachment "A").
- 12.6 The fan placement shall be as specified on NVFEL Form 700-03 "Preconditioning & Sample Collection" (Shown in Attachment "A")..

13. Quality Provisions:

13.1 The technician is responsible for:

- 13.1.1 Performing the installation and removal of test vehicles in accordance with this instruction.
- 13.1.2 Documenting the performance of the applicable steps on NVFEL Form 700-03 "Preconditioning & Sample Collection" (Shown in Attachment "A").
- 13.1.3 Verifying that data requested is accurate and complete on NVFEL Form 700-03 "Preconditioning & Sample Collection" and the form is signed and dated.

Attachment A
Preconditioning and Sample Collection
NVFEL Form 700-03

Preconditioning and Sample Collection

Vehicle ID #		Test Number	
--------------	--	-------------	--

Fuel Type: Volume: **Main Tank:**

Equivalent Test Weight: pounds Actual Dyno HP: Hp

Manf. Set Coefficient A:	Manf. Target Coefficient A:
--------------------------	-----------------------------

Manf. Set Coefficient B:	Manf. Target Coefficient B:
---------------------------------	------------------------------------

Manf. Set Coefficient C: Manf. Target Coefficient C:

Target Coastdown time: Shift Schedule

Fan Placement: _____

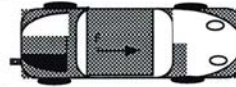
Additional Fan Placement:

Drive Code: **Front Wheel Drive** Set Tire Pressure to: **45 psi**

Vehicle Preconditioning

_____ The tire pressure set @ _____ psi.

_____ Hood is open, fan(s) is (are) positioned within 12 inches and operational. Indicate the placement of the fan(s) below:



Record odometer on Form 700-01, Test Parameters

Paired Data

Sample Collection

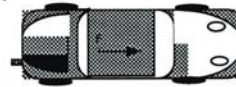
Twin Roll Dyno - Record last dyno usage time: _____

_____ Electric Dyno has been warmed and calibrated today

_____ The tire pressure set @ _____ psi.

_____ Noresco controller is in the "TEST" mode. Temp and dewpoint within tolerance..

_____ Hood is open, fan(s) is (are) positioned within 12 inches and operational. Indicate the placement of the fan(s) below:



I have performed all steps in accordance with the requirements of Test Procedure 700.

Technician's ID _____

Date _____